REMARKS

Applicant responds to the Response to Notice of Non-Compliant Amendment by listing the text of the withdrawn claim 2.

Claims 1, 2, 4-8 and 10-12 are pending in this application following this amendment and should be in condition for allowance upon further consideration.

Applicant respectfully traverses the rejection of claims 1, 4-8, and 10 based on §112. The claims need to be reasonably definite. The Examiner rejects the claims because certain terms are qualitative rather than quantitative, and he deems this language "relative," uncertain, and indefinite. Again, the standard is reasonableness. The claims do not need to be precise.

The Examiner rejects claims 1 and 10 for reciting "low modulus" and "high elongation." At page 12, lines 22-29, the specification identifies that high elongation equates to over 500% elongation, which makes it easier to bag simple and complex preforms with few wrinkles. Low modulus materials are described as those characterized by STRETCHLON 700 polyester or STRETCHLON 800 nylon bagging films. Accordingly, these terms are reasonably definite because of the definition that the specification provides for each. These definitions in the specification carry over to the claims, because the same words are used. The definitions need not be set forth explicitly in the claim because it is set forth adequately in the specification. A skilled artisan could use either of the two identified films to use the claimed process. The requirements of §112 are satisfied.

The Examiner also rejects claims 1 and 10 asserting that the term "modest" renders these claims indefinite. "Modest" appears in the context: "The flow media having modest permeability, including fill fibers that act as weirs." The specification focuses on control of the infusing flow front to achieve a suitable product. For example, at page 12, lines 3-16, the specification identifies that Taconic 7195 TEFLON impregnated glass is a preferred flow media that has "modest permeability." The entire passage reads:

> The key to successful infusions is not the speed with which the preform is infused, but rather the quality of the infusion. Maintaining a controlled wave front with lower permeability flow media over the preform gives cleaner infusions. The flow media we prefer to use should allow the resin to flow laterally slowly enough that the resin can uniformly drop down through the preform to wet out and completely fill the preform with a wedge shaped flow profile. In a controlled flow front, the resin front on the bag side of the preform is only 2 or 3 inches ahead of the resin front on the tool side of the preform assuming flow media is placed only on the bag side of the preform and

> infusion includes lateral flow through the media followed by downward flow to fill the preform. We prefer to control the relative permeability of the flow media to that of the preform to achieve this orderly, albeit relatively slow, infusion.

This description of a "modest permeability" makes the claim reasonably definite and satisfies §112. A skilled artisan would understand to use Taconic 7195 flow media to use the process.

The Examiner rejects claims 1 and 10 because "stiff but pliable" with respect to the flow media also is relative and, in his opinion, indefinite. As just described, the specification teaches a person to use Taconic 7195 for the flow media. At page 12, lines 20 and 21, the specification describes that "stiff but pliable" means that the flow media reduces or eliminates mark off on the bag side of the laminate. The claim language itself includes this function for the "stiff but pliable" flow media. The claims are reasonably definite and satisfy the requirements of §112.

The references individually or collectively fail to describe a process that uses two vacuum bags for vacuum integrity and control of bag relaxation made from a material that also resists wrinkling in combination with a flow media of the specified characteristics to provide control of the flow front. Control of the flow front and laminate quality are key factors for making aerospace-grade composites. No reference teaches or suggests throttling the vacuum lines to achieve a matched mass flow rate, as claim 12 claims.

Claims 1, 6, 7, & 8 are rejected based upon U.S. Patent 4,132,755 (*Johnson*) in view of U.S. Patent 5,427,725 (*White*) in further view of EP 0 816 438 (Cytec), U.S. Patent 5,129,813 (*Shepherd*) and U.S. Patent 6,090,335 (*McClure*). A skilled artisan would not combine these five references in the manner the Examiner asserts without using hindsight based upon Applicant's own teaching, because these references fail to teach or to suggest the alleged combination. They only are combined because Applicant has determined and taught others to do so to provide a reliable vacuum-assisted resin infusion process. The process of the present invention allows the manufacture of aerospace quality composite parts having a high fiber volume fraction.

White describes a process for resin transfer molding and a preform used in the process. *White* tackifies a preform to make it shapeable, adds a matrix resin and co-cures the tackifier and resin. *White* does not mention vacuum-assisted resin infusion. Applicant did not invent tackifying, but *White* fails to teach that tackifying can or should be used in a vacuum-assisted

resin infusion process. *Lang* does not suggest its use either, so no one would combine *Johnson* and *White* in the manner that the Examiner has.

The Examiner asserts that it is logical to combine *Johnson* and *White* because *White* teaches that tackified preforms allow making of net shape composites by allowing stacking of individual layers. *Johnson* and *White* are combined solely because what Applicant has taught rather than from any logic in the references themselves. The Examiner applies hindsight. Furthermore, Applicant uses a tackifier that toughens the composite to improve its damage tolerance. *White* fails to teach or to suggest such a tackifier. He simply wants the preform layers to stick together during the layup. There is no reason to combine *Lang* and *White*, but, even if you do, you do not get what Applicant teaches and claims.

Cytec describes tackified prepreg systems that make a toughened composite. Cytec uses a non-toughening, elastomeric tackifier, and, therefore, teaches away from what Applicant describes and claims. Cytec achieves toughening in the composite by using a toughening amount of a particulate engineering thermoplastic blended into the resin and impregnated onto the tackified fabric to form a prepreg. Cytec teaches away from the present invention by suggesting the use of thermoplastic particulates mixed with the resin to achieve the toughening and in teaching the need to use a prepreg rather than a preform. If one were to substitute what Cytec teaches for *White* and to carry that back into *Lang*, the resin would already be inside the vacuum bags and there would be no need for infusion. Accordingly, no one would combine these references because what they teach clashes. Applicant claims a toughening tackifier, anyway, rather than a non-toughening tackifier in combination with a toughening amount of a particulate engineering thermoplastic. There is no sense to the rejection in the Examiner's assertion to combine Cytec with *Johnson* and *White*. Doing that fails to suggest the steps that Applicant claims and leads to a cobbled mess. Skilled artisans do not go from reference to reference picking isolated and disparate teachings and elements from each without clear direction that one is a substitute for another or that one will solve a problem understood to plague another. That is not the situation with these references, and no one would combine them without resorting to what Applicant has taught.

Resin infusion in the present invention is designed to replace the use of prepregs which are expensive to make, expensive to store, and short lived because the resins react while in storage, even when frozen.

Shepherd describes embossed vacuum bag, methods for producing and using the bag. The Examiner asserts that *Sheppard* teaches using a low modulus, high elongation nylon vacuum bag, and concludes, then, that it is logical to use it in the manner that Applicant claims in conjunction with Cytec, *Johnson* and *White*. Applicant does not claim to have invented low modulus, high elongation vacuum bags. Applicant's invention is a method that uses such bags to produce aerospace composites. The novelty in Applicant's invention resides in the method steps used rather than in Applicant discovering a new material that can be used in a conventional process. *Sheppard* discusses bag relaxation, which is probably why the Examiner cited it. The essential feature of the *Sheppard* bag, to achieve its objects, however, is that it has impressed on it a 3-D pattern which defines a plurality of interconnected channels (col. 2, lines 56 – 61). Applicant does not use such a bag material. The *Sheppard* bag may have the low modulus and high elongation attributes, because it relaxes to form a fully conformal surface over the layup - - *Sheppard* uses prepregs - -, but *Sheppard* fails to cure all the deficiencies of *Johnson, White,* and Cytec.

McClure describes a process of forming fiber reinforced composite articles using an in situ cured resin infusion port. It fails to overcome the deficiencies in the rejection that Applicant has raised with respect to *Johnson*, *White*, and the other cited references. The Examiner asserts that *McClure* teaches the use of resin flow media. If that is true, as Applicant pointed out earlier, the skilled artisan would not use the flow media in *Lang* because *Lang* creates resin distribution channels in the bagging material and does not want or need flow distribution media. Using it in *Lang* would increase waste and cost. Therefore, the Examiner cites *McClure* purely by the application of hindsight based upon Applicant's own teaching. He sees that the claim requires flow media, so he has found a patent that uses it. It is illogical, however, to use *McClure's* flow media with *Johnson's* system insofar as going so provides two elements to perform the same function when either one would do fine along.

The Examine refers to discussion of what *McClure* characterizes as the prior art as *McClure's* teaching or suggestion to use flow media. The flow media is described as a cloth which tends to wick the resin to facilitate resin flow. *McClure* actually teaches not to use such flow media because it requires labor to place it, specialized procedures for disposal and clean-up, and added time. Further, *McClure* describes a cloth that facilitates flow while Applicant claims a flow media having weirs (i.e. dams) that inhibits flow.

The combination of references asserted by the Examiner fail to teach or to suggest the method steps recited in claims 1, 6, 7, or 8. The cited references do not suggest using a tackifier containing toughening agents. They do not suggest using two, low modulus, high elongation vacuum bags to minimize bag wrinkles. They do not suggest an open weave flow front by having fill fibers act as weirs. They do not suggest a stiff but pliable flow control media to prevent bag side markoff. They do not together suggest infusing the resin through the flow media. Because the combined references lack all these limitations of claim 1, the rejection for obviousness must be withdrawn.

The rejection should also be withdrawn simply by recognizing that the skilled artisan would never combine teachings from five different references.

With respect to claim 6, the Examiner asserts that *White* tackifies the preform at elevated temperature and, then, impregnates the preform with resin while the preform is hot. Claim 6, however, specifies that the inner vacuum bag is applied when the preform is at an elevated temperature. *White* does not suggest this step.

With respect to claim 7, the Examiner asserts that *White* also teaches partially curing the tackifier before infusing resin. Claim 7, however, recites that vacuum debulking occurs at an elevated temperature. *White* does not discuss vacuum debulking so it cannot suggest doing it at an elevated temperature.

The action is confusing because it refers first to *White* and, then, reverts to *Lang*. *Lang* does not suggest vacuum debulking, although it does teach evacuating the cavity around the preform prior to introducing resin to avoid entrapping air bubbles in the resin. Of course, if this cavity is evacuated and so, too, is the cavity that holds the spacer, there is no driving force to create the temporary resin distribution channels. Therefore, *Lang* is internally inconsistent in what it teaches. In any event, it does not teach vacuum debulking at an elevated temperature.

With respect to claim 8, the Examiner asserts that *Lang* teaches use of carbon fiber and epoxy resin and that *White* teaches an epoxy resin tackifier. The selection of materials, however, does not overcome the deficiencies of all the references with respect to the method steps of claim 1.

Claims 4, 5, and 10 are rejected based upon *Johnson*, *White*, Cytec, *Shepherd*, *McClure*, and U.S. Patent 5,364,584 (*Imanara*). *Imanara* describes a process for producing

fiber-reinforced resin moldings, including slanting a mold 15 - 90 degrees prior to and during resin infusion.

Claims 4 and 5 depend from claim 1 and are patentable because of the deficiencies already noted with respect to *Johnson*, *White*, Cytec, *Sheppard*, and *McClure*. While *Imanara* suggests tilting the preform, it does not overcome all the other noted deficiencies.

Claim 10 is an independent claim that requires use of an open weave, modest permeability flow control media having fill fibers that act as weirs to resist resin infusion in conjunction with tilting the preform. Applicant has already argued that *Johnson* and the other references cited with respect to claim 1 fail to teach or to suggest such a media or flow control step. *Imanara* teaches structural reaction injection molding (SRIM) in matched dies at high injection pressure. *Imanara* does not use a flow control media, especially one whose purpose is to resist flow of resin. *Imanara* is inapplicable to what claim 10 requires because *Imanara* is SRIM rather than a vacuum-assisted resin transfer molding process. It in combination with the other references still fails to teach a flow media with fill fibers acting as weirs to achieve improved control of the resin wavefront in a bagged preform.

Claim 11 is rejected based upon *Johnson*, *White*, Cytec, *Shepherd*, *McClure*, and U.S. Patent 4,120,632 (*Stoeberl*). *Stoeberl* describes molds for producing plastic boats in matched dies. *Stoeberl* teaches "passages [that] are effective to relieve foam that is pumped into the mold cavity between the mold halves..., allowing air to escape from the mold cavity while throttling the air released to build up back pressure or to create a suction effect." Claim 11 requires throttling the vacuum lines to control the mass flow rate of resin. *Stoeberl* fails to teach or to suggest this step. Claim 11 also is patentable because the other references fail to teach or suggest what Applicant recites as the process steps in claim 1, as previously argued.

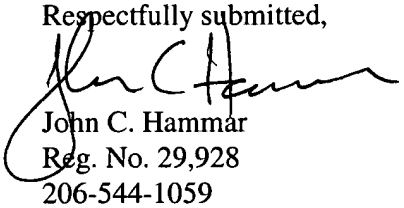
Claim 12 is rejected for obviousness over *Johnson* in view of *Stoeberl*. Claim 12 requires in a vacuum-assisted resin transfer molding process, throttling the vacuum lines to achieve a mass flow rate of resin into a debulked preform at a rate where the in/through the preform is substantially equal to the rate in the vacuum lines. That is, the throttling means that resin entering the cavity does not pool or accumulate in the flow media because the same mass that is entering in a period of time is the same mass that is infusing into the preform.

Lang double bags, but does not teach a debulked preform. *Lang* does not throttle. It feeds the resin directly into the preform or, originally, entirely into the temporary resin distribution channels. In neither case does *Lang* suggest what Applicant claims.

Stoeberl teaches throttling to create a back pressure. *Stoeberl* does not discuss equilibrating the mass flow rate into the cavity with that in the preform. *Stoeberl* does not have flow media where pooling could occur and only has fibrous sheets on the surfaces of the mold cavity rather than as a preform. The body of *Stoeberl's* boat is largely unreinforced.

Accordingly, *Stoeberl's* throttling does not overcome the deficiencies of *Johnson* and the combined references fail to teach or to suggest the invention of claim 12.

Respectfully submitted,



John C. Hammar
Reg. No. 29,928
206-544-1059